SCIENCE

ew Series
l. LXVI, No. 1698

Friday, July 15, 1927

Annual Subscription, $6.00
Single Copies, 15 Cts.

SCIENCE

OL. LXVI JULY 15, 1927 No. 1698

CONTENTS

CIENCE: A Weekly Journal devoted to the Adcement of Science, edited by J. McKeen Cattell published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal.

caster, Pa. Garrison, N. Y.

ual Subscription, $6.00. Single Copies, 15 Cts.

CIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from office of the permanent secretary, in the Smithsonian itution Building, Washington, D. C.

tered as second-class matter July 18, 1923, at the Post e at Lancaster, Pa., under the Act of March 8, 1879.

PUBLIC HEALTH PROGRESS AND RACE PROGRESS—ARE THEY INCOMPATIBLE?[1]

THE public health workers, the social workers, the civilizers, we are told, are corrupting the race; are destroying the race. By protecting us from our enemies, the bacteria and the viruses; by removing the sources of disease; by showing us how to avoid unfavorable conditions and to find favorable ones; in short, by bringing us and our environment into harmony, they are promoting the survival of the unfit; they are progressively filling the race with the weak and the degenerate who must hand on their weakness and degeneracy to their descendants. This should all be stopped. In dealing with the delicate and ailing, our motto should be: Treat 'em rough!—Let the environment kill them. That's what will produce a strong race, a fit race.

To one who has spent his life studying the unnumbered devices by which organisms of all sorts protect themselves from their enemies; who sees that their daily, their hourly occupation is the seeking of favorable conditions and the avoiding of unfavorable ones—to such an observer this proposal comes as a paradoxical surprise. The public health worker, the social worker, is not alone in this nefarious business of adjusting the organism to the environment; everybody's doing it. And by everybody I mean our brothers, the birds and beasts, our cousins, the insects and worms and plants; I mean all organisms. We ourselves have been doing this sort of thing for a hundred million years. It's going to be a hard habit to break, if we must break it.

And as we look at it, the difficulties become greater. All organisms are *forced* to defend themselves in all sorts of ways against other organisms that seek to destroy them; against bears and beetles as well as against bacteria. All organisms *must* protect themselves against the injurious forces of nature; against heat and cold and wind and wet; against starvation and against over-eating; against unfit food and drink; against bumps and bruises and broken bones; against plagues and poisons. That's what life is: a struggle for existence. If any organism ceased this struggle, ceased to select its environment, ceased to protect itself—its kind would become extinct in a generation.

[1] Address at the twenty-third annual meeting of the National Tuberculosis Association at Indianapolis, May 24, 1927.

So it is with man, with bird, with fish, with worm, with protozoan, with plant.

We can't therefore hew to the line in this matter; we can't stop this whole business of adjusting ourselves to our environment. If there is anything at all in this proposal, it must be something very special. Are there limitations that must be placed on this protective struggle? Are there certain methods of protection that organisms must not employ; methods that overshoot themselves and fall on the other side; methods that lead to degeneration and destruction instead of to the survival and prosperity that they are trying for? Are the methods of the public health worker of this sort? Or are there certain junctures in evolution when this protective work must stop, on pain of defeating its own aim? How shall we know those junctures? Has man reached one of them now? After unnumbered ages of striving for environmental adjustment must he now give that up?

Well, the point to all this—and it is beyond doubt a piercing point—comes to us from modern work in heredity; in genetics. That has revealed to us that there are perverted methods of promoting survival and propagation; perverted methods of deciding who is to survive and multiply, who to perish without offspring—perverted methods that may and do result in a degenerate population. Such a population has been produced by these methods. The fruit flies of Morgan's laboratory are the pattern and exemplar of the kind of population that the pessimistic eugenicist predicts for man; a population composed of the congenitally defective; the halt, the blind, the weak, the variously deformed and degenerate. Such things then can be done! We must sit up and take notice. What is it that underlies such results? How can they be avoided?

Experimental biology has shown that what underlies them is this. At its beginning the organism is a complex thing, containing a great number of separable substances—what we call the genes. By the interaction of these thousand substances—with each other, with the cytoplasm, with materials brought in from outside, with the forces of the environment—development takes place, the individual is produced with all his later characteristics. In early stages of development, the interactions of the genes produce new chemicals, enzymes, hormones, endocrine secretions; these again react with other products till there result, in a series of successive steps, all that we find in the body: the sex hormones, the thyroid hormone, the hypophysial hormone, epinephrin, insulin, the digestive and other secretions; the blood, the tissues, the organs, the mature individual.

But not all sets of genes are alike. Different individuals start with different sets. Some among the genes may be defective; sets containing these yiel defective products. Hormones may be produced th are deficient in quality or quantity, or both; this r sults in farther defects. If the thyroid secretion is d fective, either from poor genes or poor nutrition, t individual fails to develop normally; it becomes th pitiful half formed thing, a cretin, an idiot. If i sulin is not properly formed, diabetes results. If t sex hormones are not normal, intersexuality or oth discordant condition follows. These are types of t results which follow from the operation of defecti genes, or from defective interaction of the genes.

But chemical therapeutics discovers that disord due to defective genes can be remedied if we kn the means, just as other chemical processes may be i fluenced. The consequences of a defective thyroid s cretion are remedied by introducing the thyroid h mone with the food; the pitiful cretin becomes a n mal human being. Lack of insulin is similarly re died, by introduction of insulin from outside. T necessary chemicals can even be synthesized, made a tificially, as recent revolutionary researches show. T genes are not something mystical, unapproachab they are organic chemicals. In principle, it is cl that defects in the store of chemicals given us heredity may be supplied by other means; that un sirable things in the store of genes may be cancel or corrected; that reactions among them which t an undesirable turn may be altered, set right. these things are seen to be mere matters of techniq one needs but to know how. The great advances ready made in this direction have come in the last years. How far will they have gone in 100 yea In 1,000 years?

Wonderful possibilities are opened up by this w Unfortunate human beings that must have suffered misery, a burden to themselves and others, are m normal, useful, happy.

But consider now the farther results of an enorm future development of synthetic chemistry; of ch ical therapeutics. Defects in genes become as ope remedy as defects in nutrition. A defective thy product is replaced by manufactured thyroxin; individual is restored to normality. But his genes not changed; they remain defective; they are tr mitted to his descendants. His descendants too be treated with thyroxin. The genes of another i vidual are defective for the secretions of the pophysis; of another for the suprarenal secretion another for the reproductive hormone; of another insulin. Chemotherapy remedies all these defe for these individuals. But their descendants, re ing the defective genes, must likewise come under treatment of the chemist. In time the race thus a mulates a great stock of these defective genes. E

dividual that receives them must be treated with one more of the substitutes for the normal products of e genes. Each must carry with him an arsenal of ypodermic syringes, of vials, of capsules, of tablets. ach must remain within the radius of transportation the synthetic chemical laboratory on which he de-ends. *This* is the result of remedying gene defects.

This picture is not an attractive one. Far better the later condition of the race in which, through ck of skill in synthetic chemistry, defective genes ve been cancelled as they arise; so that each indi-dual bears within himself, in his stock of genes, an tomatic factory for the necessary chemicals. That ust be our aim; our slogan for future generations ust be: Every man his own hormone factory!

How is that end to be attained? Is there no re-urse but to strike at synthetic chemistry? Must the happy chemist be proscribed, prosecuted, impris-ed, hanged; his books burned, his teaching forbid-n, his methods of work prohibited? Must the cretin ag out his life a helpless idiot, the diabetic suffer relieved—till their own defects close their lives in isery, and so cancel their stock of genes? Are these e methods that must characterize our policy toward fects in the genes?

It certainly behooves us as rational beings to ex-nine such a situation with care; to search whether ere be not peradventure another way of meeting it. d when we do this, we find these proposed measures be totally and preposterously unnecessary, uncalled r, absurd; nay more, ineffectual. There is another course, a simpler one, a more effective one; an in-itely preferable one.

The mere survival of a genetically defective indi-dual—nay, his enjoyment of a full, a useful, a ppy, a long life—does nothing to increase the de-neracy of later generations—provided he does not opagate. Not survival alone, but also propagation, required for the perpetuation of defective genes. ithout propagation, survival is harmless, so far as cial deterioration is concerned. Can there be any estion as to which shall be the point of attack? rely we write ourselves down as asses, as doubly d triply stupid, irrational, perverse, if in order to event the perpetuation and multiplication of certain nes, we can think of no method better than to stop entific investigation, to stop humane practices, to rce our fellow beings to live and die in misery that know how to prevent. The lives of persons bear-g defective genes may be made as satisfactory, as mplete, as the most advanced methods can make m, without the smallest harm to the race—but they st not propagate.

Not the wasting away and death of the bearer of fective genes, therefore, but the prevention of his propagation, is our remedy. The method of allowing the individual's own defects to destroy him is not only hideously repulsive to our instincts, but a knowledge of genetics shows it to be ineffectual; it does not get rid of the defective genes. Most gene defects are recessive; they are therefore carried by ten times as many healthy individuals, not showing the defects, as by individuals in which the defects are manifest. The children of such healthy individuals receive defective genes, as do children of defective individuals. Congenital feeble-mindedness due to a single gene defect presents perhaps the most pronounced and the very simplest case of gene defect that has to be met. Yet East[2] and Punnett[3] have shown that to merely cancel the deficient individuals themselves—those actually feeble-minded—makes almost no progress toward getting rid of feeble-mindedness for later generations. As East pointed out, any really effective action in this direction requires that we learn in some way to distinguish the tenfold larger number of normal individuals that bear the defective genes; and that we prevent *their* propagation. To merely cut out the defective individuals themselves; particularly to do that only weakly, haltingly, ineffectually (allowing them time perhaps to propagate before death overtakes them)—as would result from withdrawal of public health measures—*that* will not touch the root of the trouble.

The *only* remedy is to stop the propagation of the bearers of defective genes. The public health worker must take this fact seriously; a burden of responsibility is placed on him; he *must* become genetically minded, eugenically minded. If he promotes, in the congenitally defective, propagation as well as survival, his work does indeed tend toward a measure of racial degeneration. But it is the propagation, not the survival, that is the central point. So fast as we can discover individuals that bear seriously defective genes—whether themselves personally defective or not—so rapidly must those individuals be brought to cease propagation.

There are great difficulties, of course. The instincts connected with propagation are strong. But those instincts are readily circumvented. They can be satisfied without the production of offspring. Thousands of individuals in every generation voluntarily relinquish the leaving of descendants. Far different is the case with any method that strikes at life itself, once that is in action. To life humanity clings with every trembling fiber of its being. The difficulties of ending

[2] "Hidden Feeble-mindedness," E. M. East, *Journal of Heredity*, *8*, 1917, pp. 215–217.

[3] "Eliminating Feeble-mindedness," R. C. Punnett, *Journal of Heredity*, *8*, 1917, pp. 464–465.

the careers of defective genes by preventing propagation of their bearers are as nothing compared with the hopeless proposal to allow defective individuals to waste away and die unaided. Can any one suppose that a race of beings so perversely stupid as to refuse to stop even the propagation of defective individuals can be persuaded to adopt the barborous, needless and ineffectual plan of killing them by the slow, the cruel method of refusing them available help in their distress?

Technically, a greater difficulty lies in the fact that the immense majority of defective genes are stored in normal individuals; and that recognition of these storehouses is not yet possible. Before that can be done, genetics must advance far beyond its present point. For no scientific advance is there greater need. Until that comes, genetics can propose no practicable plan for positive race improvement. But any single case saved from propagation is a gain. A defective gene—such a thing as produces diabetes, cretinism, feeble-mindedness—is a frightful thing; it is the embodiment, the material realization of a demon of evil; a living self-perpetuating creature, invisible, impalpable, that blasts the human being in bud or in leaf. Such a thing must be stopped wherever it is recognized. The prevention of propagation of even one congenitally defective individual puts a period to at least one line of operation of this demon. To fail to do at least so much would be a crime.

But how far is there reason to hold that public health work is indeed preserving individuals with defective genes? There can be little doubt, from the general picture presented by genetic investigation, that diversities in the genes, in the original constitution, of different individuals, affect every characteristic, of whatever sort, without exception. There can be little doubt that other things being equal, some genetic constitutions are more readily attacked by plague, by smallpox, by typhoid, by pneumonia, by tuberculosis, than are others. Certain constitutions yield more readily to extremes of temperature, to exposure to the elements, to unfit food. Certain combinations of genes are more likely to come off victorious in a struggle with a wildcat; or to survive a bite from a rattlesnake. Under such emergencies, those genetic combinations which survive are obviously more desirable. And removing any of these sources of danger—cutting off plague or pneumonia or wildcats or rattlesnakes, or subjection to cold—does permit combinations of genes to survive and propagate that otherwise could not do so. Any radical change in the environment alters the incidence of selective elimination; consequently alters the characteristics of the population in later generations.

But for all such cases the essential question is this: If the environmental agent—whether disease, weather or wild beast—can be controlled, prevented from attacking man—are the individuals thereby saved still undesirable—unfit, in other respects, to be citizens of the world? Are their genes radically defective, inevitably yielding deficient men and women, even though protected from environmental conditions that they are unable to resist? Or are they merely particular combinations that are fitted to one environment rather than another? No combination of genes yields human beings that flourish equally well in all environments. The victims of smallpox, yellow fever, hook-worm, malaria, of sunstroke, frost-bite, lions—must we believe that they are individuals with such serious genetic defects as will make them or their descendants obnoxious, degenerate, members of the community—even when those plagues have been banished by hygiene and invention?

Of course this is, for every separate case, a question of fact, to be determined by investigation. In some cases, as we have seen, it is now clear that the individuals saved *do* bear deficient genes; these are the cases for which the remedy is cessation of propagation. In certain other of the plagues of humanity the question is still open; such perhaps are tuberculosis and cancer. In certain strains of animals marked susceptibility to cancer is due to a single gene defect; if such strains are to be found in man, their members should not propagate. But we must not fall into the fallacy that was characteristic of the beginnings of knowledge in genetics—the fallacy of holding that because in some cases cancer is dependent upon a serious gene defect—therefore it must be so dependent in all cases. Cancer may be induced in strains that are seemingly quite normal—though less readily induced than in those with defective genes.

The case of tuberculosis illustrates the complexity of the biological situation met in dealing with most of the plagues of mankind. This is not my field of work and I can not speak authoritatively on the details, but to try to state the apparent situation from a general biological point of view may be of interest and provide a basis for discussion.[4]

It is clear that environmental conditions play a very large part in the incidence of tuberculosis. The rôle of the tubercle bacillus is beyond question; yet its presence is so nearly universal that it plays a relatively small part in deciding who shall, who shall

[4] Discussions of this matter that are based upon sound and adequate biological foundations are given by Lenz in Baur, Fischer and Lenz's "Menschliche Erblichkeitslehre," sec. ed., pp. 254–258, and by J. Bauer, in his "Konstitutionelle Disposition zu inneren Krankheiten," 1917, pp. 52–59. It is much to be desired that these works should become available in English translation.

ot, succumb to the disease. There is positive evience[5] that closeness of association with active cases f the disease tend to make the individual succumb; n other words, frequent infection with large numbers f the organism more readily produces active disease. gain, under-nutrition, exposure, any conditions that arkedly lower the vitality, tend to increase the numer of cases of the disease. All these may be classed s environmental conditions. On the other hand, here is strong evidence that hereditary, that genetic actors—many diverse genetic factors—play impornt rôles in determining who shall be affected witb uberculosis. Certain races are more prone to tuberulosis than others. Within a given race, it seems lear that individuals bearing certain genes, or cerin combinations of genes, are more susceptible to uberculosis than are those with others. But there no single gene, no single combination of genes, to hich alone can be attributed the greater susceptibily to tuberculosis. Various genetic types show higher sceptibility; those that yield the asthenic constituon, those that yield what is called infantilism. Any ne or combination of genes that seriously interres with proper nutrition lays the organism open attack of the tubercle bacillus; thus diabetics whatever the cause of that disease) are prone to uberculosis. A great number of diverse genes are volved in such effects; and these genes are beyond oubt mainly recessive. We do not, therefore, get d of them by the destruction of tuberculous inividuals; much the greater proportion of them is resent in normal persons. Here as elsewhere in e operation of inheritance, individuals that are emselves healthy may, and often do, produce offpring that are genetically defective; individuals that e themselves defective, and for genetic causes, may d do produce normal offspring.

Further, genes that tend to give high susceptibility attack of the tubercle bacillus may coexist with enes that give high vitality and efficiency in other spects; this Wright[6] demonstrated in his experiental work with guinea pigs. A parallel situation xists in mankind with respect to tuberculosis and tellectual qualities; the De Morgans, the Robert ouis Stevensons, can not be considered inferior types, other respects than their proneness to tuberculosis.

Such then is the biological situation; a great comlex of variable factors of many kinds, each having s influence on the incidence of tuberculosis. To atmpt to meet such a situation, to attempt to get rid of tuberculosis—merely by allowing the ravages of the disease to remain unchecked, appears unintelligent, feeble, hopeless. It is possible that a time may come when certain well-defined particular genes shall have been identified as strongly predisposing to tuberculosis, and when the carriers of those genes can be identified. When that time comes, if it ever does, the individuals bearing such genes, whether themselves tuberculous or not, should cease to propagate. Only in this manner can the genetic factors be effectively attacked. And in the meantime, the war on the environmental factors must continue. It seems probable that the genetic factors can never be practically dealt with until the environmental factors are largely controlled; this is the teaching of most practical work in genetics.

A similar situation would be met in an examination of other plagues combatted by public health measures. But for many of the matters with which the public health worker deals, there appears to be no indication whatever that the individuals preserved are undesirable, or at a disadvantage, in a world in which the attacking agent has been controlled; no indication that defective genes are playing an important rôle. There is not ground in man for holding that all differences in genes imply defectiveness in one or the other. We can not in man (as perhaps we can in the fruit fly) set up for each particular gene one type as the only normal one, compared to which all others are defective. There are many types for each gene, some adapted to one method of life, some to another. There are millions of diverse combinations of these different types, some flourishing better under one set of conditions; others under another set of conditions; none of them requiring to be considered pathological.

Our question here merges into a general biological one. Can it be maintained that *any* protective or defensive action, *any* selective control of the environment, is harmful to the race, as leading to degeneration, through the cessation of selective elimination?

Various dangers have been suggested. Increased propagation resulting from environmental control of disease may result in a greater population than the environment can comfortably support. Here the remedy, if one is required, is again obviously to slow down the rate of reproduction, as most civilized communities are doing.

Again full success in protection by one method makes it unnecessary to develop other methods. The oyster, protected by his thick shell, has not developed ingenuity, inventiveness, intellectual power. Coming in contact with another organism that has, it may go to the wall, as the oyster shows signs of becoming extinct in contact with man. This somewhat specu-

[5] See Pearl: ''Constitution and Tuberculosis,'' in ''Studies in Human Biology'' (1924), pp. 273–297.

[6] ''Factors in the Resistance of Guinea Pigs to Tuberculosis, with Special Reference to Inbreeding and Heredity.'' *American Naturalist*, 1921, vol. 55, pp. 20–50.

lative difficulty suggests no practical measures for our own case.

More palpable is the following: Complete success in any one method of defense against a particular enemy makes other methods unnecessary; the organism is no longer selected with reference to those other methods, and may lose them. Completely destroy certain pathogenic bacteria, or develop external methods of protection against them; in consequence the internal protective action of the body fluids is no longer necessary; it might in the course of generations be lost. If by clothing, houses, fire, we keep our bodies at the optimum temperature, we may or might lose in later generations the power of resisting high and low temperatures.

The extent of the occurrence of this sort of action is rather speculative. But assuming that it occurs, the result in first instance is merely that the organism no longer retains the power of resisting an enemy that does not attack it; a harmless change.

If, however, by a later change in conditions, as by a sudden overwhelming alteration in climate or an increase in the virulence of a bacterium, the methods of protection hitherto employed become ineffectual, then the organism might be driven back on its second defense; its internal power of resistance to infection, or to cold. If this has been lost, the organism might become extinct. Speculative ingenuity may suggest that this has been a cause of the extinction of some organisms that have disappeared.

But in view of the fact that control of the environment is the very fabric of life; that organisms can not live without it; that they have been practicing it assiduously for uncounted ages; and that some of them are still flourishing, it appears idle to suggest that such control must be abandoned; it appears whimsical to look for imminent degeneration or extinction through that method of action. If such were its necessary consequence, organisms must have disappeared long ago; nay, they never would have appeared. Any organism *must* admit to itself, draw to itself, seek out, those conditions that are favorable to its physiological processes; this is the daily business of life. The practice of hygiene, of public health is but one farther link in a chain that goes back to the beginning of life. Amoeba covers itself with a semi-permeable membrane, admitting some chemicals, excluding others. Protective coverings become in other animals more and more efficient—the skin, hair, feathers, the heavy shell of the oyster, the armor plates of dinosaur and armadillo. Microscopic enemies that penetrate these defences find the body fluids charged with destruction. Elaborate internal mechanisms are developed for keeping the temperature high and uniform. Strength of body, quickness, agility, the development of claws and teeth—these seize the advantage by transforming the defensive into an offensive. Acuteness of senses, cunning, inventiveness supplement all these methods; supply the lacks in any of them. Cooperative action registers an enormous advance. Shelters, clothes, are found or devised; fire taken into service; food cultivated; weapons invented; machines produced; the properties of substances tested; new ones compounded. Devices come into existence for recording the results of tests once made; for preserving knowledge as it is gained. Some organisms proceed to that systematic elaboration of methods for discovery and application of knowledge that we call scientific research; the most powerful aid yet devised for bringing the environment under control. If environmental control is harmful, the first thing to do is to stop scientific research; only so can we strike at the root of the evil. Hygiene, medicine, the arts of public health—these are not something new in kind; these are but later terms in the long series that begins where Amoeba takes in certain substances and rejects others. With the other practical arts, they result in adapting the organism more and more completely to the environment. Along this road we must indeed watch for the sporadic appearance of defective genes, and these we must cancel by the only possible method—by stopping the propagation of their bearers. But defective genes are not the characteristic result of this process; degeneration and extinction are not its normal consequence. Abandonment of environmental control; cessation of the process of adjusting ourselves to the conditions—this is unnecessary, undesirable, impossible, unthinkable. The proposal for such abandonment is merely a characteriste instance of that modernism or "modernistic-ism" so rife in art and literature, that insists at any cost of sense or plausibility in saying something that has not before been said; doubtless in the hope that by trying all propositions, some time one that is worth while will be hit. The proposal to abandon control of the environment is not a serious contribution to the practice of life.

H. S. Jennings

The Johns Hopkins University

DR. FRANKLIN P. MALL[1]

I first knew Mall in 1884 (or '86?) when I was assistant to Professor Welch in the pathological laboratory of the Johns Hopkins University. The laboratory was a small building which stood on the ground

[1] Contributed to a collection of material relating to the life and work of Dr. Mall, gathered by L. B. Schmidt of the Iowa State College of Agriculture and Mechanic Arts.

the hospital, which was then in process of con-
ruction. Mall had just returned from Germany
here he had worked in the laboratories of Ludwig
d His and brought with him the methods and ideals
f these remarkable men. He had made a strong
npression upon both and retained their interest and
iendship as long as they lived.

With the establishment of the university a system
f fellowships had been created, but at the time, save
the department of physiology in the university,
here were in the country no fellowships or any
her positions in medicine which offered a modest
pport to one engaged in medical research. All the
aching positions in medical schools throughout the
untry, with the exception of the chair of physiology
Harvard, were held by men who were active prac-
itioners of medicine as well, and the professorial
ositions were regarded as valuable adjuncts to a
edical practice. A fellowship in pathology was
stablished by the university, and Mall was the first
ncumbent. It seems remarkable when one looks
ack upon the men who held these early fellowships
the Johns Hopkins, so many of whom have become
istinguished, that opportunity for work and workers
hould have so coincided.

Mall quickly interested all the men who were asso-
iated with him and gave them an impression of his
haracter, which constantly deepened and which can
ever be effaced from their memories. The impres-
ion was all the stronger because its production was
ot consciously sought. I think that our first idea
f Mall was that he was unusual, very modest, even
hy in manner, perfectly frank and simple. He lived
life of study, and work in the laboratory had little
ontact with the world outside and little knowledge of
. He had brought a reputation with him and had
on the respect and friendship of two of the leading
en of science in Europe—not a small accomplish-
ent. Life in the laboratory was extremely simple.
Ve were all young and healthy, there was an atmos-
here of work, a happy even joyous, carefree ex-
stence and close friendships. I am sure we all
hought ourselves much more sophisticated than Mall,
ut sometimes in our talk he, usually so quiet, would
uddenly flash out with an idea, which, when one came
o think it over, seemed the wisdom of the ages. He
as helpful in criticism and suggestion and in these
lways modest and tactful.

He had a way of looking at things in his work
hich was strange to us. He sought to know the
etails of structure, not merely the cells and the tis-
ues, but the relations of these in the three dimensions
f space. Although skilled in the methods of what
as called histological research, involving the cutting
nd staining of thin sections of tissues for micro-
scopic examination, he added other methods by which parts of organs were digested away and the tissues so separated that their relations could be studied. At that time I had never heard Mall refer to Bichat, and yet both the men and the methods they used were very much alike. Mall at that time must have been of about the same age as was Bichat, when the latter was writing his famous "General Anatomy." Bichat endeavored to show the nature of the different tissues which composed organs and the interrelationship of these in structure. To do this he separated the tissues of organs by boiling, maceration and other physical means. Mall with more refined methods carried the same sort of study into the finest details of structure, he subdivided the elementary tissues into those with the same physical and chemical characteristics and studied their relationship in anatomical structure. He was skilled in the technique of injection of the blood vessels, and the course, arrangement and distribution of these in organs claimed special attention. His conception of an organ involved everything pertaining to it, including embryonic development and function. There was never haste in the publication of his researches. His work was so new and original that there was never a question of priority, and so generous was his nature that he would have welcomed and assisted a rival. His great work on the connective tissues was published some years after its completion, and the same was true of his studies of the intestinal canal. When he did publish his work, it was so complete, so well illustrated, so accurate in description, that it seemed to be final. I am particularly fond of recalling in this connection his work on the structure of the liver. Notwithstanding the great amount previously written on the embryology and histology of this organ, it was only after reading the work of Mall that I arrived at an understanding of the liver. His description was based on the lobule, its development, its growth and the relation of size to the length of capillaries. The law which he established and which governs the embryological development has been shown to govern also the growth which occurs under pathological conditions. In the minute subdivision of detail he never lost sight of the whole. He had the rare power of visualizing in the three dimensions of space and of projecting this visualization into the mind of the reader. In the great amount of the work which came from his students and which has been the main influence in giving anatomy in this country the high position it occupies, the principles involved in his early work have been followed.

He was the greatest teacher of anatomy of his time. Had he been shut up in a cloister, he would have been a teacher, for the investigator has that

quality, without which all teaching is futile, of stimulating the desire of knowing. At the time of his appointment as professor of anatomy, anatomical teaching in this country was on a low plane. With few exceptions the professors of anatomy in the medical schools were practitioners of medicine, usually surgeons, and the anatomical course consisted of formal lectures and demonstrations, so subdivided in the large audience by distance that in demonstrations each student received a very imperfect idea of the objects shown thirty to sixty feet away. The lectures were the main discipline and were supplemented by text-book recitations and by a limited course of dissections. Rarely did the student receive the stimulation to endeavor to find out things by the exercise of his own powers, nor did the discipline involve training in those powers of observation and judgment by which knowledge is obtained. The attempt was made to have the student acquire what was quaintly termed the mastery of a subject by being told or by reading descriptions of what others had seen. The method is one that has by no means been given up and may be said to be the current method of instruction in most subjects in the schools to-day. Mall's departure from this method was radical. He held the view that the essential in teaching should be directed to the development of the power of the individual, and that knowledge comes not from being projected into the student from without, but must grow from within on the material obtained by the skilled use of the senses directed on the object studied. The primary knowledge of the thing so acquired could be expanded and coordinated by lectures, demonstrations and by reading. This is the natural method pursued by children before the unnatural methods of school are substituted and the intellectual curiosity which stimulates the child to seek knowledge is killed. Mall introduced the utmost freedom of study and of teaching into the laboratory. Students have told me that they felt lost when they went into the laboratory and before they understood the spirit of the place. They were so unaccustomed to a lack of direction of their intellects. With all the freedom of study that prevailed the students were well cared for and the progress of each man followed. The teacher was always at hand to assist, often to guide and always to encourage and stimulate. The result is seen in the position of anatomy in this country to-day. There is no teacher, no student of the subject who has not directly or indirectly, consciously or unconsciously profited by the methods, the work and the ideals of this great teacher.

The best men were attracted to him, and his work has been multiplied a thousandfold by his disciples. This method of teaching is one which, though universally applicable, produces the greatest result in the hands of such a born leader as was Mall, a man who was able to say to his students, "*Come* with me along this road." There is a great difference between "come" and "go." His laboratory was a model of good housekeeping, always orderly, and he was a good provider of facilities for work. The anatomical material was abundant and well preserved, and dissection was robbed of many of the unpleasant features usually connected with it. There was an abundant store of carefully made dissections, as available for study as the books in a library.

It is interesting to attempt to form an estimate of a man by comparing him with others; extremely difficult, for men and environmental conditions are so unlike. There is such a difficulty in comparing the work of Mall with that of his colleagues, many of them men of the highest type, all differing, each in a different way exerting a great influence. It is enough to say that Mall stood in the first rank of these men.

As a last word I must speak of the great honesty of Mall which appeared in every relation, and with his honesty his perfect fearlessness. He was not a compromiser, and where his ideals of right showed him the way he fearlessly followed, no matter how difficult the road. The world has sustained a loss in his death, a place is vacant which probably will not be filled, at least not by the same type. His friends whose esteem and affection he won will like to think about him and recall in their minds the old associations, none of these giving pain. To his family he has left a great name, and his descendants may well be proud of their ancestor.

W. T. Councilman
Harvard Medical School

SCIENTIFIC EVENTS

EXPEDITION OF THE AMERICAN GEOGRAPHICAL SOCIETY TO CENTRAL PERU

An expedition from the American Geographical Society of New York will leave this week for Central Peru to explore and map the sources of the Maranón River, the principal tributary of the Amazon, and a large section of the vast forested region which lies along the eastern border of the Andes between the upper Maranón and the Ucayali River. In addition to an extensive program of topographic and reconnaissance mapping, studies will be made of the geology, meteorology and plant and animal life of the region.

To the scientific explorer as well as to the explorer for exploration's sake, the region which the expedition

will study is one of the most alluring of the many little-known areas of South America. Here on a vast plateau nearly 15,000 feet above the sea, within a hundred miles in an airline from the Pacific coast but separated from it by the lofty, snow-capped wall of the main range of the Andes, and within thirty miles of each other are the sources of three great tributaries of the Amazon—the Maranón, the Huallaga and the Mantaro.

It is a curious fact that, with all the explorations that have been made in the Amazon Basin in the past hundred years, the actual sources of the main tributary of the world's greatest river have never been carefully explored and from the standpoint of accurate mapping are practically unknown. The headwaters of the Maranón consist of a chain of glacier-fed lakes some thirty miles in length which lie close against the eastern edge of the cordillera of the Andes about fifty miles northwest of the famous American-owned copper mines at Cerro de Pasco. Although it it believed by many that in the towering crests of the Andes from whose melting snow-fields and glaciers this chain of lakes is fed, peaks will be found that will rival the highest altitudes so far determined in Peru, none of them have been accurately measured.

Of the lakes themselves little information is available. In 1909 Sievers, the German geographer, visited and described a group of small lakes which form the uppermost part of the chain. The survey made by the Intercontinental Railway Commission in the early nineties crossed the lowermost of them at the point where it empties into the Maranón. Between these two points there are only vague and conflicting descriptions by a few native travellers. A topographic survey of about 350 square miles will be made between the crest of the Andes and the secondary range which bounds the lake region on the east. This survey will be tied in to a base established at Cerro de Pasco and accurately located by astronomical observations. It is believed that the geological studies in this section will be especially interesting. North and south of the region the Andes are known to be highly mineralized. At Mina Ragra a short distance south of the point where the survey will begin are located the mines of the American Vanadium Corporation, from which comes the major portion of the world supply of vanadium.

From the lake region a reconnaissance traverse checked by frequent astronomical observations will be carried for about a hundred miles northward along the upper Maranón, thence eastward through the densely-forested montana to the Huallaga and Pachitea Rivers, and back to Cerro de Pasco. This part of the work will include about 400 miles of reconnaissance surveys. Topographic surveys will be made of small areas at critical points along the route, meteorological records will be kept and observations on the plant and animal life recorded as a basis for distributional maps now in process of construction by the American Geographical Society.

The cartographic work of the expedition will be of great interest to geographers and kindred scientists because it will fill with accurate surveys one of the largest blanks which still exists in the map of South America. In general, maps of Hispanic America are highly inaccurate and scientists have been, for that reason, greatly hampered in their work all over this great realm. For the past six years the American Geographical Society has had a large staff of expert cartographers engaged in assembling material for a great map of Hispanic America. This map is on the scale of 1:1,000,000 and conforms to the standards of the International Map of the World. It is being compiled from original surveys and will represent, when completed, the total present knowledge of the cartography of Hispanic America. The Hispanic American governments as well as American and European explorers and development companies have shown enthusiastic interest in the task of assembling material for the map. The society's collection now numbers thousands of original surveys. There still remain many gaps, however, in areas in which no surveys have been made. The region selected for the present expedition is one of the most critical of these areas. The society hopes by future expeditions to be able to fill many other important blanks on the map.

From the standpoint of the surveyor the expedition will be highly important in that it will afford an opportunity to test out in the field the methods of rapid mapping which the society has been developing during the past seven years. The expedition will be equipped with a set of instruments which represent a maximum of accuracy and speed of work with a minimum of bulk and weight. They include the new Weld theodolite, the Barr and Stroud range finder, and an extremely small and light wireless receiving set for obtaining time signals for longitude.

The expedition, which is in charge of O. M. Miller, of the society's School of Surveying, will leave New York on June 23 on the steamer *Santa Teresa* of the Grace Line. Kaspar Hodgson, son of C. W. Hodgson, of Yonkers, will be a member of the party. The party will also include, beside assistants, a geologist who will study the mineral resources of the region.

HONORARY DEGREES CONFERRED BY YALE UNIVERSITY

HONORARY degrees were conferred by Yale University on the occasion of the two hundred and twenty-

sixth commencement exercises on June 22, when Professor William Lyon Phelps, public orator, presented the candidates and President James Rowland Angell conferred the degrees. Those conferred on scientific men are as follows:

Charles Value Chapin

PROFESSOR PHELPS: A graduate of Brown and of the Bellevue Medical College in New York, Dr. Chapin has a magnificent record as a promoter of health and foe of disease. He has been health officer of the city of Providence since 1884 and city registrar since 1889. He is the leading figure in the development and standardization of public health practice in the United States. To him we owe the formulation of the entire modern viewpoint in the control of communicable disease. His book on "Sources and Modes of Infection" (1910) is highly important. In 1906 the American Medical Association had voted that Dr. Chapin's method would do "infinite harm"; to-day the whole world follows his lead. Dr. Chapin has no talent for publicity; but those who are familiar with the history of the movement for public health look back, and at, and up to him.

PRESIDENT ANGELL: To have been instrumental in materially improving the health and happiness of untold millions is a noble achievement. This fact Yale would publicly recognize by conferring upon you the degree of doctor of laws and admitting you to all its rights and privileges.

John Jacob Abel

PROFESSOR PHELPS: Dr. Abel was this year awarded the Willard Gibbs Medal, for having done more than any other living scientist, without pecuniary advantage to himself, "to promote enjoyment of life." He is a graduate of the University of Michigan and of Johns Hopkins. For seven years he studied at various European universities, since 1893 has held the chair of pharmacology at Johns Hopkins and in 1920 received the degree of doctor of laws from Cambridge. He is the foremost pharmacologist in the United States. He has in large measure determined the trend and character of this science in America. Some twenty years ago he discovered epinephrine, the active principle of the suprarenal gland. Then he rested and in 1910 got his second wind. His recent activities and discoveries have been remarkable, all the more so because he has been a lone worker. His discovery of amino acids in the circulating blood was the foundation for our modern conception of protein metabolism. His investigation of the active principle of the pituitary gland promises to yield significant results. In 1926 he announced the preparation of a pure crystalline insulin, which is going to be of the highest importance in the cure of diabetes. He is truly a great discoverer and a great benefactor, though he is too busy to know it.

PRESIDENT ANGELL: It is a peculiar pleasure to me, who have known you from boyhood, to be the agent through whom, in recognition of your extraordinary contribution to the understanding of the conditions of health and of disease and thus to the relief of human suffering, Yale herewith confers upon you the degree of doctor of science, admitting you to all its rights and privileges.

Alfred North Whitehead

PROFESSOR PHELPS: Mathematician and philosopher. Born in England, a graduate of Trinity College, Cambridge, and later fellow and senior mathematical lecturer, since 1924 he has been professor of philosophy at Harvard. In 1925 he was given the Sylvester Medal by the Royal Society, for his work *Principia Mathematica.* He is one of the leading authorities in the sphere of mathematical physics and his publications exhibit one of the greatest excursions in pure reason in the history of thought. For sheer intellectual effort in the most abstract yet fundamental regions of thought there are very few things comparable to the work he has already accomplished. The scientific foundation of metaphysical speculation is his especial field; and in many domains his knowledge begins where that of other experts leaves off. He is an intellectual pioneer, dwelling on the farthest unexplored frontiers of thought; and of late he has been irresistibly drawn to the philosophy of religion, bringing to these problems a mind filled with scientific knowledge and fresh as the morning. Every subject that he treats he touches with new life; he has in the highest degree learning, originality and intellectual charity. America is proud of the presence of such a man.

PRESIDENT ANGELL: Because she desires to honor great learning and extraordinary insight, and not less to recognize a rare ability to render significant and interesting to the intelligent layman scientific and philosophical issues ordinarily regarded as hopelessly abstruse, Yale confers upon you the degree of doctor of science and admits you to all its rights and privileges.

Sir James Colquhoun Irvine

PROFESSOR PHELPS: Principal of St. Andrews. Born in Glasgow, he took his bachelor's degree at St. Andrews with special distinction in chemistry and zoology; his doctorate he took at Leipzig. He became professor of chemistry and later dean of the faculty of science at St. Andrews, and in 1921 principal and vice-chancellor. In 1925 he was knighted; the list of his honors, degrees and decorations need not be given in detail. In the chemistry of the sugars he is one of the foremost living authorities; but nothing human is strange to him. He restored to its original condition the university chapel, where services were held before the time of Columbus. He is beloved by the leading men of letters of Great Britain, and was the only man in the world who could have persuaded Sir James Barrie to make a speech. He secured the great dramatist to deliver a baccalaureate address at St. Andrews, his first appearance on the platform. Principal Irvine's interests and sympathies extend as far as humanity; he is a first-class amateur

actor, a lover of music and the fine arts, a Scottish humorist and a conversationalist *summa cum laude*. Such a personality can not be defined or even known by any special learning; for research is simply one of his natural activities. We are happy to number him among the sons of Yale.

PRESIDENT ANGELL: In recognition of your striking accomplishments as an executive, your well-earned renown as an unofficial ambassador from Scotland to other lands less bonnie, including England, but primarily by reason of your brilliant and solid achievements as a chemist, Yale confers upon you the degree of doctor of science and admits you to all its rights and privileges.

George Hoyt Whipple

PROFESSOR PHELPS: Dr. Whipple was born in New Hampshire, took his B.A. at Yale in 1900, his doctor's degree at the Johns Hopkins Medical School and became a member of the faculty. Research professor in the University of California, his work attracted such attention that when the new medical school was established at Rochester he was called as director. He designed the buildings, selected the faculty and has brought the institution into deserved distinction. His own special field of research is pathological anatomy. His Puritan inheritance has been tempered by Baltimore, Charleston and California, so that he has lost its angularities without losing its grit.

PRESIDENT ANGELL: Because she wishes honorably to recognize your outstanding career in the field of your profession and to voice her confident expectation of further high service from you in your present responsible post, your alma mater confers upon you the degree of master of arts and admits you to all its rights and privileges.

William Buckhout Greeley

PROFESSOR PHELPS: A graduate of the University of California in 1901 and of the Yale School of Forestry in 1904, he is chief forester in the U. S. Forest Service. He was attached to the Corps of Engineers in the world war, serving in France two years. He was promoted to be lieutenant-colonel of the 20th Engineers and chief of the Forestry Section. He received the award of the Distinguished Service Medal of the U. S., the Legion of Honor of France and the Distinguished Service Order from Great Britain. His judgment of men is as good as his professional knowledge; it can never be said of him that he can not see the forest for the trees.

PRESIDENT ANGELL: Latest of the distinguished line of graduates of the Yale School of Forestry who have acted as chief forester of the United States, in recognition of your distinguished services to your profession and to your country, your alma mater desires to honor you by conferring upon you the degree of master of arts and admits you to all its rights and privileges.

GRANTS FOR SCIENTIFIC RESEARCH OF THE AMERICAN MEDICAL ASSOCIATION

THE Committee on Scientific Research of the American Medical Association has made grants for research which include the following:

Dr. Victor C. Jacobsen, professor of pathology in Albany Medical College, to study the effects on living tissues of high voltage cathode rays. ($1,200.)

Mr. Charles V. Green, of the Michigan State College of Agriculture and Applied Science, to study the inheritance of hemophilia and color blindness in man. Mr. Green will work under the immediate direction of Dr. Charles B. Davenport. ($750.)

Dr. W. H. Manwaring, Stanford University, California, to continue work on the physiological relationship of anaphylaxis to immunity, studied by means of blood transfusions and organ transplantations. ($500.)

Dr. Arthur M. Yudkin, assistant clinical professor of ophthalmology, to be used in the section of ophthalmology at Yale University to investigate the chemical and physical composition of the intra-ocular fluids in experimental animals and also the changes which may take place as a result of cataract formation produced experimentally. ($500.)

Dr. O. Larsell, of the University of Oregon Medical School, to aid in his research on the hemopoietic effects of nuclear extractives. The fund will be applied toward determining which ingredients of the nuclear material are responsible for the stimulation of blood formation which has been observed in experimental and human anemias. ($500.)

Dr. Harold Cummins, associate professor of anatomy to Tulane University, who will be a guest worker for a part of the summer in the Carnegie Laboratory of Embryology, to study with the aid of the extensive material assembled in this laboratory, the history of the contours of the fetal hand and foot, with particular reference to individual variation and the correlated development of skin patterns.

Dr. J. Earl Else, of the Else Dudman Nelson Clinic of Portland, Oregon, to study the reconstruction of the lower end of the esophagus.

Roy L. Moodie, of Santa Monica, California, to enable him to prepare for publication the illustrations for a discussion of surgery in pre-Columbian Peru.

SCIENTIFIC NOTES AND NEWS

DR. VICTOR C. VAUGHAN, formerly dean of the Medical School of the University of Michigan, has been awarded the Kober Medal, given by the Association of American Physicians for distinguished work in preventive medicine and public health.

THE French Society of Electricians has presented its Mascart Medal to Sir Joseph Thomson.

DR. LUDWIG PRANDTL, director of the Kaiser Wil-

helm Institute for Aeronautical Research in Göttingen, was awarded a gold medal on the occasion of a lecture that he gave recently before the Royal Aeronautical Society of London.

M. Paul Helbronner, known for his geodetic work in the French Alps, has been elected a member of the Paris Academy of Sciences, to fill the vacancy caused by the death of Haton de la Goupillière.

Dr. George H. Whipple, dean and professor of pathology, University of Rochester School of Medicine and Dentistry, was awarded the honorary degree of doctor of science by Colgate University at its recent commencement.

The degree of doctor of science has been conferred by De Pauw University on Dr. William Albert Riley, head of the department of animal biology of the University of Minnesota.

Ohio Wesleyan University, at the recent commencement exercises, conferred the degree of doctor of science on Eugene Wesley Shaw, geologist for the Standard Oil Company of South America.

The University of Leeds has conferred the honorary degree of doctor of science upon Dr. A. G. Perkin, professor emeritus.

The following degrees will be conferred by Birmingham University: Dr. A. C. Seward, Downing professor of botany in the University of Cambridge; Dr. Arthur Lapworth, professor of chemistry, University of Manchester; Sir David Ferrier, emeritus professor of neuropathology, King's College, London; Sir Watson Cheyne, Bart., and Sir Walter Fletcher, secretary of the Medical Research Council.

The list of honors conferred by the King of England on the occasion of his birthday on June 3, as given in *Nature*, includes the following names of men of science and others associated with scientific work: *Order of Merit:* The Honorable Sir Charles Parsons, in recognition of his eminent services in scientific research and its application to industries. *G.B.E. (Civil Division):* Sir Frank Heath, until recently secretary to the Department of Scientific and Industrial Research, and Sir Richard Threlfall. *K.B.E. (Civil Division):* Dr. C. E. Ashford, headmaster of the Royal Naval College, Dartmouth. *Knights:* Mr. W. G. Lobjoit, until recently controller of horticulture, Ministry of Agriculture, and Professor C. J. Martin, director of the Lister Institute, London. *C.M.G.:* Professor R. W. Chapman, professor of engineering in the University of Adelaide. *C.I.E.:* Mr. A. G. Edie, chief conservator of forests, Bombay. *C.B.E. (Civil Division):* Mr. D. J. Davies, government analyst, Department of Public Works, Newfoundland. *O.B.E. (Civil Division):* Mr. G. W. Grabham, government geologist, Khartoum; Mr. T. F. Main, deputy director of agriculture, Bombay, and Mr. V. E. Pullin, director of radiological research, War Office.

Professor William A. Waldschmidt, assistant professor of geology in the Colorado School of Mines, for the past five years, has resigned from the faculty in order to accept a position in the geology department of the Midwest Refining Company, Denver.

Dr. Malcolm H. Bissell has resigned as associate professor of geology at Bryn Mawr College and will spend next year as an honorary fellow in geography at Clark University.

Sir Humphry Rolleston, Bt., regius professor of physic, has been appointed to represent the University of Cambridge at the third Imperial Social Hygiene Congress at Westminster from October 3 to 7.

Professor Fulleborn, of the Hamburg Institute for Tropical Diseases, has been invited by the Argentine government to visit South America to study hookworm disease.

The Rawson-MacMillan expedition, being sent out by the Field Museum of Natural History, sailed from Wiscasset, Maine, on June 25, for Labrador and Baffin Land. This expedition is being financed by Frederick H. Rawson, of Chicago, and is led by Commander MacMillan. Among the members of the museum staff who sailed with the party are William D. Strong, Alfred C. Weed, Arthur G. Rueckert and Sharat K. Roy. The party will remain in the Arctic for fifteen months and will establish a shore station in the Eskimo village of Nain, Labrador.

Erich F. Schmidt, assistant in archeology in the department of anthropology of the American Museum of Natural History, has joined the field party of the Oriental Research Institute of the University of Chicago, to assist in an archeological reconnaissance of Asia Minor.

Dr. Waldemar Jochelson, who has been the guest of the American Museum of Natural History during his visit to America, is now preparing to return to Russia, where he has accepted a position as division curator of the Museum of Anthropology and Ethnography of the Academy of Sciences, Leningrad, and as lecturer on ethnology at the Leningrad University.

Dr. Charles A. Kofoid, chairman of the department of zoology of the University of California, has left Berkeley to attend the international congresses on zoology and genetics in Europe, and to visit the leading scientific laboratories of Northern and Central

Europe. At the International Zoological Congress in Budapest, Hungary, which takes place in September, he will read a paper on "Human Intestinal Protozoa and their Relation to Diseases in Man." From that meeting Dr. Kofoid will go to the International Congress of Genetics in Berlin, Germany.

Dr. Alfred N. Richards worked last year at the National Institute of Medical Research in London, having been granted leave of absence from the chair of pharmacology in the University of Pennsylvania Medical School.

The non-resident lecturer in chemistry under the George Fisher Baker Foundation at Cornell University for the first term of the year 1927–1928, October 1, 1927, to February 1, 1928, will be Dr. Paul Walden, professor of chemistry and director of the chemical institute of the University of Rostock. While at Cornell, Professor Walden will lecture upon Non-Aqueous Solutions, Stereo-Chemical Problems and Optical Inversion, and will hold a weekly colloquium.

Dr. Alfred Adler, Vienna, will give the introductory lecture at the fourth International Congress for Individual Psychology, which will take place in that city from September 17 to 19. The first session will be devoted to the subject of "The Prevention and Treatment of the Psychoses." Sunday will be devoted to the prevention and treatment of problem children and criminals, and Monday to lectures by prominent scientists of Vienna. The lectures will be in English, French or German.

Sir Joseph Thomson, O.M., delivered the tenth Sylvanus Thompson memorial lecture before the Röntgen Society, London, on June 14, taking as his subject "The Structure of the Atom."

A bust of Emil von Behring was recently unveiled in the hall of honor of the University of Mexico, of which he had been made a doctor *honoris causa* in 1910.

Pinel, the French specialist in mental diseases, died in 1826, and, on May 30, 1,277 scientists and physicians met at the Sorbonne to pay tribute to his memory. He was regarded as the first to treat insanity as a disease and apply humane methods of treatment.

After the death of Sir William Macewen, professor of surgery in the University of Glasgow from 1892 to 1924, a committee was formed to promote a fund for the purpose of commemorating his life and work. The first purpose of the fund was to procure a bust for presentation to the university and a replica to Lady Macewen. The second purpose was the establishment of a Macewen Memorial Lecture, and the third the foundation of a Macewen Medal in the Class of Surgery. We learn from the *British Medical Journal* that the busts have been presented to the university and to Lady Macewen and the medal has been founded and the first award made. The first memorial lecture was delivered by Professor Harvey Cushing, of Harvard University.

A bronze bust of the late Alexander Smith, for many years professor of inorganic chemistry at the University of Chicago, has been recently presented to the university by Mrs. Smith. *Industrial and Engineering Chemistry* states that as the late Professor Nef was the founder of the department of chemistry and as Professor Stieglitz shared equally with Professor Smith in assisting Professor Nef in the upbuilding of the department, it has seemed fitting that the university should also possess busts or paintings of Professors Nef and Stieglitz and a movement to provide funds for these has been started by a committee of graduates of the department. The busts or paintings of the three men will ultimately be placed in the library of the George Herbert Jones Laboratory, the new research chemistry building about to be erected. Contributions to the fund should be sent to Dr. J. W. E. Glattfeld, of the department of chemistry of the University of Chicago, who is treasurer of the committee.

Dr. John G. Williams, a specialist in roentgenology and a pioneer in Brooklyn in the development and use of deep X-ray therapy, died on July 2, aged fifty-four years.

Nature reports the death on May 30 at the age of ninety-five years of Surgeon-General Henry Cook, formerly dean of the faculty of medicine of the University of Bombay.

The deaths are also announced of Dr. G. von Tschermak, emeritus professor of mineralogy and petrography in the University of Vienna, aged ninety-one years, and Dr. Anton Wassmuth, formerly professor of mathematical physics in the University of Graz, aged eighty-two years.

We learn from *Nature* that Corpus Christi College, Cambridge, has celebrated the two hundred and fiftieth anniversary of the birth of the Reverend Stephen Hales, who was born in 1671, died in 1761, and was buried in the south transept of Westminster Abbey. For fifty years Hales was curate of Teddington, and it was there he wrote his "Vegetable Statics" of 1727. A fellow of the Royal Society and a foreign member of the Paris Academy of Sciences, Hales's scientific work took a practical turn, and he was instrumental in improving the ventilation of ships

and prisons, his work on which entitles him to be called a public health pioneer.

A meeting was held recently in the American Museum of Natural History with the object of establishing in New York City an astronomical society for amateurs and was presided over by Dr. Clyde Fisher. Professor Henry Fairfield Osborn, president of the museum, made the welcoming address. Other speakers were Dr. Oswald Schlockow, district superintendent of public schools of New York City; Mr. John A. Kingsbury, secretary of the Milbank Memorial Fund, and Mr. George H. Sherwood, director of the museum. Of the audience present, 340 signed applications for membership. Dr. Fisher was elected temporary president.

The Sigma Zeta chapter of Sigma Pi Sigma National Physics Fraternity was installed at William and Mary College, June 2, with seventeen charter members. Professor H. E. Fulcher, of Davidson College, Davidson, N. C., was in charge of the installation. A banquet was held after the installation and addresses were made by Dr. R. C. Young and others.

The thirty-second annual conference of the Bunsen Society for Applied Physical Chemistry was held in Dresden, from May 26 to 29, under the presidency of Dr. Mittasch, of Ludwigshafen.

The fifty-sixth annual meeting of the American Public Health Association will be held at Cincinnati from October 17 to 21, with headquarters at Hotel Gibson. In conjunction with it the Ohio Society of Sanitarians and the Ohio Health Commissioners will hold their annual meetings. Each of the nine sections of the association—laboratory, health officers, vital statistics, public health engineering, industrial hygiene, food and drugs, child hygiene, public health education and public health nursing—will hold individual section meetings. In some instances two or more sections will combine for joint meetings. The topic for discussion at the forum session is "Has Prohibition promoted the Public Health," Professor C.-E. A. Winslow, of Yale University, presiding. One session will be given to the discussion of mental hygiene from the angle of the home, the school and the industrial field. An analysis will be made by a special committee on the health programs in operation in normal schools and colleges and will be supplemented by constructive suggestions. Dr. Herman N. Bundesen, health commissioner of Chicago; Dr. William H. Park, of the New York City Health Department Laboratories; Dr. Clarence E. Smith, of the U. S. Public Health Service, and C. W. Larson, of the U. S. Department of Agriculture, are among the specialists asked to give the most recent developments in the sanitary production and handling of milk. Several luncheon and dinner meetings will be held by sections, including laboratory, public health engineering, industrial hygiene, food and drugs and public health education. Besides a special session on venereal disease control, a round-table luncheon conference has been scheduled. Trips to points of interest in and around Cincinnati have been arranged by the local committee.

The *Journal* of the American Medical Association reports that under the auspices of the Swiss Goiter Committee, an international conference on goiter will be held in the aula of the university buildings in Berne, Switzerland, on August 24, 25 and 26. The president of the conference, Dr. H. Carrière, will give the opening address on the general distribution of goiter, and among other speakers will be Professor L. Aschoff, Freiburg; Dr. David Marine, New York; Professor de Quervain, Berne; Dr. McCarrison, Coonoor, India; Professor Galli-Valerio, Lausanne, and Professor Wagner von Jauregg, Vienna. The assembly will be welcomed by the officials of the canton and the city of Berne. There will be a demonstration in the surgical clinic by Professor F. de Querin, on August 27, and in the afternoon a trip to the poor farm with a demonstration of cretins. The conference was first planned by the Swiss Goiter Committee in 1923, and had to be postponed until this year.

The Department of Agriculture will participate in the Arkansas River Flood Conference on July 14 and 15, at Tulsa, Okla. E. A. Sherman, associate forester of the Forest Service; S. H. McCrory, of the division of agricultural engineering of the Bureau of Public Roads, and H. H. Bennett, of the Soil survey, of the Bureau of Chemistry and Soils, will represent the department in connection with phases of flood control which affect agricultural activities. At the conference, phases of flood control, particularly by means of reforestation, control or erosion by terracing, planting of cover crops, and by proper grazing, will be discussed.

The U. S. Department of Agriculture announces that the new unit known as the Food, Drug and Insecticide Administration became effective on July 1. W. G. Campbell will be in charge. Congress created the Food, Drug and Insecticide Administration recently for the purpose of separating work involving scientific research from the work of law enforcement. The new arrangements involve no change in the policy of enforcement and other acts concerned. The laboratories of the Bureau of Chemistry that are now engaged on food and drug control work will operate under the new unit. Mr. Campbell was a lawyer before joining the department of agriculture about twenty years ago. P. B. Dunbar, Ph.D., the assistant chief of the new unit, entered the service of the B

eau of Chemistry in 1907, and since 1925 has been ssistant chief.

THE Accademia dei Lincei of Rome, founded in 603, has received an annual donation of $4,275 from he Rockefeller Institute for the purchase of scientific eriodicals.

THE 250,000th Leitz Microscope has recently left he works. It has been a traditional policy to give ach 50,000th microscope to an institution or indiidual responsible for the development of science. These microscopes, which represent milestones in rogress, have been presented as follows: The microcope bearing serial No. 50,000 to the German Tuberulosis Sanatorium in Davos, Switzerland; the microcope No. 100,000 to Dr. Robert Koch, in Berlin; he microscope No. 150,000 to Dr. Paul Ehrlich, in rankfurt; the microscope No. 200,000 to Dr. Martin Heidenhain, in Tübingen; the microscope No. 250,000 o the Institute for Tropical Hygiene, in Hamburg.

SURGEON-GENERAL HUGH S. CUMMING, U. S. Pubic Health Service, has arranged through the deputy inister of health of the Dominion of Canada for a oard of officers of the public health service to visit Montreal to make an intensive survey of the typhoid ituation in that city, and to secure the facts as to the ource and extent of the outbreak. The board will ecure such information as might be needed to enable t to submit recommendations to prevent the spread f typhoid from Montreal into the United States. The officers detailed on the board are Surgeons Leslie L. Lumsden, James P. Leake and Clifford E. Waller, nd Sanitary Engineer H. R. Crohurst, all men of experience as sanitarians in the public health service.

THE work of the branch laboratory of the Bureau f Entomology, Department of Agriculture, at Tallah, La., has been seriously hampered by the Misssippi flood, according to a statement issued by the epartment. The substance of the announcement folows: A report received from this station says, in ffect: "We are very busy salvaging things. . . . Evidently our air field will be under water for a long me yet, possibly a month, but the water has fallen nough so that we are able to start moving out our sting machinery. . . . All electrical equipment is, f course, ruined, but the remainder of the machinery as not rusted much. Delicate parts are ruined. . . There are two areas near here which were not overooded, owing to protection from small private levees, nd we think we can soon get started in these areas n our important research work, especially the hoper. One stretch of deep water will probably have o be crossed by boat all summer. . . . All experiments outh of Tallulah will have to be reached by boat for long time, as the highway there is under ten feet f water in some places yet." Another laboratory of the bureau, situated at Baton Rouge, La., is on high ground, not affected by the flood, and none of the experiments in progress there have suffered.

UNIVERSITY AND EDUCATIONAL NOTES

THE cornerstone of the new teaching hospital of the University of Pennsylvania's Graduate School of Medicine, to be built at a cost of $2,000,000, was laid on June 14. In conjunction with the remodeled Polyclinic Hospital buildings, the new plant will completely replace the former Medico-Chirurgical, Polyclinic and Diagnostic Hospital plants, which have become merged as parts of the Graduate School of Medicine.

THE Medical College of Virginia, Richmond, as a residuary legatee, will receive from the Martha Allen Wise estate approximately $130,000 for the care and treatment of patients at the St. Philip Hospital, a large modern colored institution owned and operated by the college for teaching purposes.

THE Eli Lilly and Company of Indianapolis have recently given to the University of Kansas School of Medicine a research fellowship for the special study of hypertension, under the supervision of Dr. Ralph H. Major, head of the department of internal medicine. The fellowship amounts to $1,800 a year and was recently given to Mrs. Vera Johnsmeyer Jones.

THE University of Edinburgh has received a gift of £40,000 from Mr. Thomas Cowan, a shipowner of Leith, to assist in furthering the success of the scheme for the establishment of a residential house for male students attending the Edinburgh University. Mr. Cowan's previous gifts to the university, amounting to £30,000, are being applied to provide a hall of residence for students, which is to be called Cowan House.

DR. G. CARL HUBER, dean of the Graduate School of the University of Michigan, has been appointed to succeed the late Dean Alfred H. Lloyd.

DR. ELMER A. HOLBROOK, for the past five years dean of the School of Mines and Metallurgy at the Pennsylvania State College, has resigned. Dean Holbrook is to become dean of the combined engineering and mining school at the University of Pittsburgh.

ROLLAND M. STEWART, professor of rural education, has been appointed director of the Agricultural Summer School of Cornell University, to take office after the close of the school this summer, which will be under the direction of Professor George A. Works, who will next year become dean of the Library School of the University of Chicago.

NEW appointments at the Medical College of Virginia, Richmond, include Dr. William B. Porter, professor of medicine; Dr. Sidney S. Negus, professor of

chemistry; Dr: J. C. Forbes, assistant professor of chemistry; Dr. Lewis C. Punch, associate in pathology, and J. G. Jantz, associate in anatomy.

At Armstrong College, Newcastle, Mr. Clement Heigham has been appointed professor of agriculture, in succession to the late Professor D. A. Gilchrist, and Dr. J. W. Heslop Harrison to be professor of botany, in succession to Professor J. W. Bews, who has resigned.

DISCUSSION

MEAN SEA-LEVEL AS AFFECTED BY SHORELINE CHANGES

It seems to have been quite generally assumed that carefully made tidal observations, extending over a period sufficiently long to eliminate the disturbing effects of meteorological and astronomical causes, will give a value for mean sea-level which at any given place will remain essentially constant. As mean sea-level determinations afford the only satisfactory basis for detecting slow elevation or subsidence of the continent, the validity of the assumption noted is a matter of no small importance.

A number of years ago the writer became convinced that the mean sea-level surface bordering an irregular shore is itself an irregularly warped surface, and that its elevation changes appreciably with changes in the form of the shoreline. Special studies of this problem are now in progress, and a full discussion will be published at an early date. It is desired here to indicate briefly some of the facts upon which the theory of a fluctuating mean sea-level surface is based. The facts are not novel, but their consequences seem not fully to have been appreciated, especially by those citing records of mean sea-level observations as proof of slow continental subsidence or elevation.

We may begin with the simple and obvious case of a bay connecting with the open sea by a narrow inlet and receiving the waters of inflowing rivers. It is known that under such conditions the influx of river water will raise the mean level of the bay. A striking example of this phenomenon is presented by Kennebecasis Lake or Bay, which receives the waters of the St. John River and connects with the sea at St. John, New Brunswick, by the very narrow tidal channel famous for producing the "reversible falls" —from the sea into the embayment when the tide outside is high; from the embayment back into the ocean when the tide outside is low. According to the Canadian hydrographic authorities, the mean level in the embayment is at least two feet higher than the mean level outside. There can be no doubt that many such embayments along our coasts have abnormally high mean levels, the excessive elevation generally amounting at most to but a few inches, but in some cases rising as high as a foot or more. What would happen if storm waves, tidal currents, or other agencies widened or deepened the inlets between sea and embayment, or created additional inlets, so that better egress of waters from the embayment to the sea would be insured? Obviously the ponding of the river waters would be less effective, and the mean level of the embayment would fall. Thus would be created, within the embayment, fictitious indications of an uplift of the land. Or suppose that the inlet were gradually narrowed or shallowed through the deposition of débris by wave or tidal currents, so that the escape of the river waters was more and more obstructed. In this case the mean level within the embayment would gradually rise, and one would find there fictitious indications of a gradual subsidence of the coast.

Let us consider next the case of mean sea-level as affected by prevailing wind directions. It is not difficult to understand that if the wind blows constantly in a given direction, the level of a water body over which it blows must be permanently distorted with an abnormally low level toward the windward shore, and an abnormally high level along the lee shore. A land mass separating two water bodies so affected will have distinctly different mean water levels on its two sides. If one of the water bodies be the ocean, and the other a bay or lagoon separated from the ocean by a bar through which a very narrow inlet permits restricted ebb and flow of the waters, the difference in mean levels on the two sides of the bar will persist. If, however, the inlet be widened, or if new inlets be broken through the bar, the water levels will approach equality; and this will result in a fictitious indication of land elevation on one side of the bar, and a fictitious indication of subsidence on the other.

It can be shown that tidal conditions alone, unaffected by either river inflow or wind direction, will produce local inequalities of mean sea-level which are subject to fluctuations with changes in the form of beaches and inlets. To take a single example, imagine a bay or lagoon separated from the sea by a bar through which a narrow inlet admits the rising ocean so slowly that high tide in the lagoon never rises as high as high tide in the ocean. When the ocean waters fall, the waters in the lagoon will flow back into the ocean, but so slowly that before the lagoon is emptied the ocean waters begin again to rise. Thus low tide in the lagoon is always higher than low tide in the ocean, just as high tide in the lagoon is always lower than high tide in the ocean. Now such tidal

inlets are usually broader at the top, and narrower below, with the result that the waters enter and leave the lagoon most freely when the tide is high. As a consequence, the discrepancy between high tide levels in the two water bodies is not so great as that between the low tide levels; and the mean level of the lagoon is therefore higher than the mean level of the ocean. Changes in the number or breadth of inlets much cause changes in the mean level of the lagoon; and such changes are of common occurrence.

The shallowing or deepening of inlets; the growth of bars across the mouths of bays formerly free from such shore features, or the destruction of bars by storm waves; the narrowing of inlets by sand-spit growth, their widening by wave or current action, or the breaching of bars by new inlets formed by storm waves or by the outburst of impounded land waters; any and all of these must be potent causes of local changes in mean sea-level in harbors, bays or lagoons where are found conditions approximating those described above. Nor do the conditions described exhaust the list of those which may give rise to local differences in mean sea-level. They are merely examples intended to illustrate the fundamental principle that local changes in the form of the shore may, under appropriate conditions, produce local changes in mean sea-level. Such changes in mean sea-level may be gradual or sudden, depending on the nature of the shore changes responsible for them; and they may amount to fractions of an inch or to a number of inches, depending on the form and size of inlets and bays and on the range of the tides. Where gradual and imperceptible, yet of significant amount, they are apt wrongly to be attributed to progressive, slow coastal subsidence or coastal elevation.

DOUGLAS JOHNSON

COLUMBIA UNIVERSITY

QUANTITATIVE DETERMINATION OF ROCK COLOR

THE need for standardization of rock colors has been realized by many petrographers. Sedimentationists, especially, have desired a color standard. In meetings of the Sedimentation Committee of the National Research Council, the possibility of basing important deductions as to alteration and environment of sediments upon slight color differences has been suggested. The difficulty in investigating these suggestions has been the lack of means of detecting the requisite small color variations. The best standard of colors now in use is the Ridgway chart. In fact, its use in sedimentation has become so desirable that the Sedimentation Committee has taken steps toward the preparation of a more simple and cheaper chart, based on that of Ridgway, but especially adapted to field and laboratory descriptions of sediments.

Because the writer does not know of any application of quantitative color measurements to geologic investigation, he believes that the attention of mineralogists, petrographers, sedimentationists and others interested in color work should be called to the fact that instruments are available by means of which colors can be analyzed and synthesized quantitatively. No details of the construction and manipulation of these colorimeters need be given here for this information can be supplied by the dealers selling these instruments. Their wide range of application is indicated by their successful use in industrial plant control and research in a variety of industries including dye, paint, varnish, ink, and soap manufacturing, sugar refining and other industries. Since these instruments have proved their usefulness in practice, it is believed that they will be found to be useful also in the field of pure science wherever color is involved. Their value in petrographic research has been demonstrated by the writer in his study of the relationship between structure and color of the shales of the Cromwell Oil Field of Oklahoma.

The most simple and obvious method of determining rock color by direct comparison of rock fragments with a standard color chart is at best only qualitative. Comparisons of streaks produced in the usual way by drawing fragments of the material over an unglazed porcelain plate enable smaller color differences to be detected than is possible with the use of chips but this method is also unsatisfactory. Streaks vary with slight differences in hardness and texture of the rock as well as with differences in composition. The texture, hardness and whiteness of the streak plate and the pressure applied in obtaining the streak are also significant variables. Moreover, such a streak can not be representative of the sample as a whole because it involves too small a quantity of material and it has the added disadvantage of being neither reproducible nor easily preserved for future reference.

Many of these difficulties can be overcome, as was done in the study of the Cromwell shales, by selecting an average sample, grinding the rock and sieving it. A portion of the powder passing the one sixteenth millimeter screen can then be pressed into a cardboard frame, previously mounted on a datum card, and covered with an ordinary thin cover glass. Black binding tape such as is used in preparing lantern slides serves to hold the glass to the rest of the mount. Such a record is permanent and can be filed. It overcomes the objections of the above-mentioned methods, but it too has some disadvantages. First, the mounting of the powders is time-consuming and,

secondly, after all this work has been done, the color differences detectable by the eye are not always sufficiently small to be of value in the investigation. The fundamental need, a method of greater sensitivity, remains.

Such was the case in the Cromwell problem when a timely advertisement in SCIENCE called the writer's attention to the color photometer. In order to test the applicability of the instrument to the study of the shales in question, the writer submitted samples of shale powders passing the one sixteenth millimeter screen to the dealer for trial tests. The results agreed so well with certain chemical determinations that the writer believes that he is warranted in suggesting the use of the color photometer in other investigations. When the investigation of the Cromwell shales is completed, it is hoped that the application of quantitative color data to petrographic research will be demonstrated conclusively. As stated in the beginning, the purpose of this brief paper is merely to make better known a color-determining device applicable to liquids, powders and massive solids, both heterogeneous and homogeneous, capable of giving quantitative data which can be presented graphically. Such an instrument may prove of great value in other geologic problems such as those dealing with changing environments under which sedimentary beds have been deposited, color changes produced in rocks during metamorphism, and in other types of investigation. The color of mineral streaks can now be placed on a quantitative basis. Doubtless, other applications will suggest themselves to the reader.

OLIVER R. GRAWE

MACKAY SCHOOL OF MINES,
RENO, NEVADA

A NEW FUNDAMENTALIST STRONGHOLD

"THE Des Moines University, Des Moines, Iowa, is now the property of the Baptist Bible Union of North America . . . A President has not been elected, but in the meantime the Board of Trustees announce that no one will be retained on the faculty who is not a Christian in the sense of having been born again . . . Some professors will teach no longer in the university because their views are decidedly modernistic . . . No professor will be retained who believes in evolution, or who does not accept the Bible as the infallible word of God . . . The highest educational standards will be maintained . . . Des Moines University will teach the supernaturalism of Christianity as opposed to the naturalism of modernism which is prevalent to-day."

The above, taken from a publication of the Baptist Bible Union, is published because the situation should be thoroughly understood by scientific men. Twenty of the faculty, including two deans, have resigned. The writer, who a year ago accepted a two-year contract as professor of biology, with the promise of freedom in the teaching of evolution is among those leaving.

N. M. GRIER

HATHAWAY PARK,
LEBANON, PA.

QUOTATIONS

STEEL TURNS TO RESEARCH

SCIENCE is to work for the United States Steel Corporation. To be sure, the greatest organization of its kind in the world has long had its laboratories, but it has been their main function to make more or less routine analyses and to control the processes whereby ore is converted into hundreds of products ranging from wire to girders. No startling discovery in the chemistry of iron and steel stands to their credit. The corporation has made its greatest technical strides in engineering—in lowering production costs, in introducing new machinery, in increasing tonnage. Convinced, no doubt, by the example of other large industrial organizations and above all by Sir Robert Hadfield, of Sheffield, and the great German ironmongers, the United States Steel Corporation has decided to create a department of research and technology under the direction of Dr. John Johnston, of Yale, a scientist ably qualified by technical education and experience to explore a field in which scientific and industrial honors are to be won.

Judge Gary's announcement of what his board of directors must have regarded as a daring innovation is phrased with characteristic but guarded optimism. The finance committee is to keep an eye on the research laboratory. While the corporation "has no money to waste intentionally," Judge Gary comments, "we have money to expend if necessary." Miracles are not to follow the rubbing of the lamp of science by a chemical Aladdin. "We do not expect you can go along at a very rapid rate to begin with, or, perhaps, at any time, but we will have patience, as you must all have patience."

Some research is better than none, particularly if the spirit in which it is conducted is that of the university. How successful the new department of research is destined to be must depend largely on the policy adopted. Such experienced directors of research laboratories as Dr. W. R. Whitney, of the General Electric Company, and Dr. C. Kenneth-Mees, of the Eastman Kodak Company, have argued for an absolutely free hand. Money-making must not infect the laboratory. Paradoxically, the most money is

made by laboratories least concerned with it—by men who have dabbled in the Einstein theory and the mysteries of the Bohr atom and stumbled on principles applicable to industry. If purely commercial standards are to guide the research director he finds it difficult to attract men of the finest scientific type. His net result is merely a heightening of technical efficiency, an improvement in finished products. Grant a laboratory the right to work untrammeled and both science and industry gain. It was the adoption of this large-visioned policy that made the discovery of ductile tungsten possible—a discovery that unexpectedly gave us electric lamps of an economy and brilliancy undreamed of twenty years ago, radio tubes that have made broadcasting and television twentieth century triumphs, and deeply penetrating X-ray tubes that have been a boon to the sick.

The richest assets of some of our largest corporations are not their physical properties but the discoveries made in laboratories where research has been conducted for its own sake. Perhaps because these assets can not be even approximately appraised, at least one corporation carries its priceless patents on its books at the valuation of one dollar.—*The New York Times.*

SCIENTIFIC BOOKS

The Ferns (Filicales). Vol. II. *The Eusporangiatae and other relatively Primitive Ferns.* F. O. BOWER, Sc.D., LL.D., F.R.S., pp. 344, many figures. Cambridge, the University Press. 1926.

FOR more than forty years Professor Bower has been recognized as a leader in the study of the Pteridophytes; and this work, the second volume of a comprehensive treatise on the ferns, of which the first appeared in 1923, is especially welcome to those, who in these days when morphology is rather discredited still feel that the subject not only is far from exhausted, but will again be revived when some of the current botanical fashions are out-moded.

The present volume treats in detail the Eusporangiatae and the more primitive families of the Leptosporangiates, and is a contribution of the first importance. It records the latest conclusions of the author as to the structure and classification of the ferns.

Not the least valuable feature of the present volume is the attention paid to the fossil ferns, as well as to the living ones; and the comparison of the latter with their ancient relations is constantly borne in mind in an endeavor to construct a system of classification which, approximately at least, will represent the true genetic relationships, and throw light upon the origin of the existing ferns.

Professor Bower recognizes three types of sporangium-development, and on this basis he arranges the families in three categories, *viz.:* Simplices, in which all the sporangia of a sorus are formed simultaneously; Gradatae, in which they are of different ages, formed in basipetal succession; and Mixtae, in which sporangia of different ages are mingled in the same sorus. The Simplices are the most primitive, the Mixtae the most specialized.

There are two types of sorus, marginal and superficial, *i.e.,* borne on the lower surface of the leaf. The marginal sporangia are believed to be the older type, although the superficial sori are characteristic of the Marattiaceae as well as of some other paleozoic ferns. The present volume deals with the Simplices and Gradatae, of which fourteen families are recognized.

Before considering the living ferns, a chapter is devoted to a group of fossils, Coenopteridaceae, which have no existing representatives. There are three families of these: Botryopterideae, Zygopterideae, and Anachoropterideae. They are all confined to the Palaeozoic, occurring from the Upper Devonian to the Permian.

The author concludes that the Coenopteridaceae include an assemblage of more or less synthetic types which may probably be assigned to the Filicales, but which do not show any close relationships with existing ferns.

Of the living Filicales, it is pretty generally admitted that the two Eusporangiate families, Ophioglossaceae and Marattiaceae, are the most primitive.

In his earlier writings Professor Bower separated the Ophioglossaceae from the Filicales, but in the present work he has restored them to a place among the ferns, where there is no doubt they belong. It is true that their exact relationship with the other ferns is not easy to determine.

While almost nothing is known of the geological history of the Ophioglossaceae, there is very strong evidence that they are the most primitive, and presumably the oldest, of the living ferns. There seem to be sufficient resemblances to the fossil Coenopterideae to warrant the assumption of a remote relationship with that order.

Although a very full description of the external morphology is given by the author, there are certain points that might be criticized. In the discussion of the venation in Botrychium, for instance (p. 43), Professor Bower emphasizes the difference between the open venation in Botrychium and the reticulate venation of Ophioglossum; but he fails to note the two types of venation found in Botrychium, although he figures these. The simpler, and probably more primitive species, *e.g., B. Lunaria, B. simplex,* have "Cyclopteroid" venation, while the larger species show a

midrib and lateral veins like those of the typical ferns. Now the transition from the cyclopteroid venation of Eu-botrychium to the simple reticulate venation of the cotyledon of *Ophioglossum Moluccanum,* for example, is not a very great one. A similar transition from the open venation to the reticulate is shown by Professor Bower in Marsilea (p. 179, Fig. 461). In short, the contrast between the venation in Ophioglossum and Botrychium is not so marked as Professor Bower believes.

The statement (p. 57), "In the ontogeny of the Pteridophytes a coherent body of tissue called the stele, partly made up of elements having a truly cauline origin, exists from the first, and it serves to connect up adjacent leaf-traces," is certainly open to question. A most careful study of the ontogeny of Ophioglossum, especially *O. Moluccanum,* has shown as conclusively as possible that the whole of the vascular skeleton of the axis is of foliar origin and that there is no truly cauline stelar tissue. This is true also for Botrychium and probably for Helminthostachys, as well as for the early stages, at least, of the Marattiaceae.

It may be said that Professor Bower seems to be aware of the difficulty in harmonizing the stelar theory with the conditions that exist in Ophioglossum.

Professor Bower's studies on the development of the sporangium in the Ophioglossaceae are quite the most complete that have been made, and are amply treated in the present volume. One may venture to differ from his conclusions in one particular, *viz.,* the nature of the sporangial spike. There is good evidence that this is not an appendage of the leaf, but a structure coordinate with the whole sterile segment. Both in *Ophioglossum Moluccanum* and *Botrychium Lunaria* there is a dichotomy of the very young leaf primordium, the branches forming respectively the fertile and sterile segments.

A sufficiently complete account of the gametophyte is given, but the embryo and young sporophyte, especially in Ophioglossum, are not treated as fully as might have been wished. Why the young sporophyte in *O. Moluccanum,* with its functional cotyledon, should be considered less primitive than that of the other species in which the early leaves are rudimentary, is hard to understand; nor will the conclusion that Ophioglossum is less primitive in structure than the other genera be accepted without question. Space will not permit a fuller discussion of these points.

The very distinct order Marattiaceae is of particular importance in the phylogeny of the ferns, since unlike the Ophioglossaceae, to which they are undoubtedly related, there are abundant fossils obviously allied to living forms.

In the later Palaeozoic, fern-like fronds with sori similar to those of existing Marattiaceae are found, and in the older Mesozoic rocks occur fossils much like the living genera.

The statement (p. 102) that the very young sporophyte of Danaea is "protostelic," is incorrect, as there are several distinct xylems belonging, respectively, to the leaf traces which have united to form the solid stele.

The relationships of the Marattiaceae to the other ferns are difficult to determine. They seem to be relics of a Palaeozoic and Mesozoic stock which have come down to the present with little change and have not given rise, directly at least, to any of the existing Leptosporangiates.

In the enumeration of the number of living Marattiaceae (pp. 124–125), there is an obvious typographical error. Christensenia (Kaulfussia) has only two species, not 26, as indicated in the table.

To some extent intermediate between the true Eusporangiatae and the Leptosporangiatae is the small family Osmundaceae with two genera, Osmunda and Todea, and 17 species. Like the Marattiaceae, the living species are but remnants of a once much more extensive order. The earliest fossils of Osmundaceae are in the Permian, where perfectly preserved stems closely resembling the structure of living species are found.

The intermediate character of the Osmundaceae is shown in the gametophyte, embryo and sporangia, as well as in the anatomy of the adult sporophyte. This is excellently summarized on page 148.

The three remaining families of Simplices, Schizaeaceae, Gleicheniaceae and Matoniaceae, like the Osmundaceae, are undoubtedly relics of once much more predominant types. Of these the Schizaeaceae lead up to the series of Leptosporangiates with marginal sori, while the Gleicheniaceae are the most primitive of the series with superficial sporangia.

The Gleicheniaceae, and the related Matoniaceae, are very uniform in their structure; but the Schizaeaceae differ greatly among themselves, and their relations to the other ferns, both living and fossil, are by no means clear. Possibly going back to the Carboniferous, and certainly to the Jurassic, they show great variety both as to external form and anatomy. Their sporangia, however, are quite uniform in type.

Probably an offshoot of the Schizaeaceae are the heterosporous Marsileaceae, which agree closely with the Schizaeaceae in their anatomy and in the development of the sporangia.

During the Mesozoic, especially the Cretaceous, species of Gleichenia were abundant in the northern regions, extending even to West Greenland. Fossils resembling Gleicheniaceae occur in the coal measures, but there is some doubt as to their real nature.

The first family of the Gradatae, the Hymenophyllaceae, is a very natural one, all of the nearly 50

pecies being referable to the two closely related enera, Hymenophyllum and Trichomanes. Their eological history is obscure, but the latest conclusion s that the family is not an extremely old one. Their earest relationship is probably with the Schizaeceae.

Formerly included in the Hymenophyllaceae is the monotypic genus Loxsoma from New Zealand; but it as now been separated as the type of a separate family, Loxsomaceae, which also includes three species of recently described second genus, Loxsomopsis. Professor Bower believes that the Loxsomaceae are related to the Dicksoniaceae.

The most radical change in classification is the eparation of the Cyatheaceae, to which most of the ree-ferns belong, into three families, *viz.*, Dicksoniaeae, Protocyatheaceae and Cyatheaceae, the latter ncluding only the three genera, Cyathea, Hemitelia nd Alsophila. The Dicksoniaceae have marginal sori, nd are believed to have no relation to the Cyatheceae, in which the sori are superficial The family Protocyatheaceae is proposed to include two genera, Lophoria and Metaxya.

Professor Bower notes a remarkable peculiarity of he young sporangia in Metaxya and the Cyatheaceae n which they differ from all other ferns that have een investigated, *viz.*, the apical cell of the young porangium is two-sided, instead of three-sided. Figre 55 suggests the segmentation in the antheridium f a moss.

The family Plagiogyriaceae is proposed to include he single small genus Plagiogyria. It is to some exent a synthetic type, intermediate between the Gradtae and Mixtae. "It is a relatively primitive type, ut not very closely allied downwards to any one of he known primitive Ferns."

The last family discussed in the present volume s the Dipteridaceae, with the single genus Dipteris, as o whose relationship there has been some controversy.

The final chapter is an excellent summary of the onclusions reached from the detailed study of the ifferent families. This chapter includes maps showg the present distribution of several of the most mportant families, as well as their occurrence in a ossil condition. There is also a diagram showing the elationships of the families discussed in the text.

Professor Bower's long continued and exhaustive inestigations in the development of the sporangium ave made him the leader in this important subject, nd he has treated it admirably in the present volume. t is this perfect mastery of the subject which makes s classification, based mainly upon sporangial charcters, so satisfactory. There will probably be little issent from his conclusions.

One could wish that less space had been devoted to e elaborate details of stem-anatomy, and somewhat more to the gametophyte and embryo-sporophyte, especially to the question of the origin of the vascular system.

The conclusions reached by recent studies on the origin of the vascular tissues of the Eusporangiatae point to a foliar origin for the bundles of the axis, and these results are hardly given adequate attention by Professor Bower. It is by no means unlikely that further investigations on the vascular bundles of the Leptosporangiates will show that in them also, there is no "stele" in the sense used by the author.

Professor Bower is to be congratulated on the completion of the second volume of this very important undertaking, and the final one will be looked forward to with the keenest interest. To all students of the Pteridophytes these volumes will be indispensable.

DOUGLAS HOUGHTON CAMPBELL
STANFORD UNIVERSITY, CALIFORNIA

SPECIAL ARTICLES

THE INFLUENCE OF X-RAYS ON THE DEVELOPMENT OF DROSOPHILA LARVAE

DURING the past two years we have been engaged in carrying out experiments the results of which we have hoped would give some definite data concerning certain fundamental aspects of radiation effects on biological processes. As a preliminary report we wish to present some of the observations made on the influence of X-rays on a given biological process, namely, the development of Drosophila larvae into pupae. The larvae employed in our experiments have been raised from an original culture of Drosophilae obtained from Dr. J. H. Northrop who had grown these flies under aseptic conditions for many generations; and we have maintained the same conditions.

Our procedure, briefly stated, has been to wash larvae (mean age, 2.5 days) out of a seeding flask on to a piece of aseptic voile, then to transfer them by a method of random sampling to wells in paraffin blocks, or to paraffin permeated pill boxes (in which case the boxes were then set in wells in paraffin blocks). A Kelly-Koett X-ray machine, supplied with 12.5 cm. spheres for spark gap, has been used throughout.

We observed that the larval stage was significantly prolonged, and that the fraction of the total number of irradiated larvae reaching the pupal stage was sensibly the same as for controls, when the conditions of irradiation were as follows: Spark gap 2 cms. distance between spheres; M. A., 8; target distance, 30.5 cms. Three experiments were then performed in each of which three lots of larvae were irradiated

for the same period (one hour) to test the reproducibility of this effect.

The values obtained for the mean duration of the prepupal period, expressed in days, were as follows:

Experiment	*Irradiated*	*Controls*	*Difference*
1	8.35	5.18	3.17
2	8.37	5.04	3.33
3	8.04	4.83	3.21

In another group of experiments larvae were irradiated with radiations, a larger proportion of the energy of which was due to radiations of short wavelength. The conditions of irradiation were as follows: Spark gap 8 cms. between spheres; M. A., 5; target distance 54 cms.; filter 1.0 mm. aluminum and 0.5 mm. copper. The X-ray bulb was contained in a lead drum with a circular aperture of 13.5 cms. diameter. The periods of irradiation were varied, being 50, 100, 150, 200, 250 and 350 minutes, respectively, the corresponding mean duration of the prepupal period, *expressed in days,* being 5.76 ± 0.08; 6.02 ± 0.04; 6.39 ± 0.11; 6.77 ± 0.05; 7.02 ± 0.10; 7.46 ± 0.08; 7.87 ± 0.12, while the value for the controls was 5.63 ± 0.05 (where the precision measure is the a. d. and the number of independent observations for each irradiation interval was four). *These data indicate that the mean duration of the prepupal period is an increasing function of the period of irradiation, under otherwise fixed conditions of irradiation, at least within the interval studied.*

These results suggested the possibility of observing an effect of the radiations just described when employed in a manner similar to that utilized in determining "depth dosage" in radiation therapy, where either water or paraffin phantoms are used in conjunction with the ionization chambers placed at various depths. To this end paraffin blocks were prepared, 25 by 25 by 2.5 cms. with cylindrical wells at the center of one of the large faces of each. These wells were 2.5 cms. in diameter and 0.5 cm. deep. The larvae to be irradiated were selected from a batch of prepared larvae by a method of random sampling and distributed in the wells mentioned above and in a similar well utilized for the controls, aseptic technique being employed throughout. The wells were then covered with a piece of paraffin-permeated paper and sealed, following which perforations were made in the paper lid. The blocks were now stacked so that the edges of the square faces coincided and the wells were accordingly co-axial. Previously air vents had been arranged in the paraffin for ventilation which was facilitated by the use of an electric fan. The stacked blocks were so placed under the X-ray bulb that the centroid of the target lay on the common axis of the cylindrical wells.

Experiments were performed in accordance with the procedure just outlined, in which the period of irradiation was six hours and the distance from the target to the upper face of the top paraffin block was 54 cms. The resulting mean duration of the prepupal periods, *expressed in days,* for the larvae in the various blocks was as follows: 8.37; 7.90; 7.16; 6.47; 6.17; while the mean value for the controls was 5.57 days.

Obviously, it would be desirable to have a measure of the time of irradiation required to produce the same extension of the mean prepupal period in the different layers rather than or in supplement to the data given above. We have been unsuccessful with experiments of this kind, because the facilities for producing a sufficient radiation intensity available at present in our laboratory are such that the period of time required to effect significant changes in the larvae irradiated at the lower levels is so great that it is disadvantageous to maintain the larvae in the unnatural environment. In the experiments performed so far we have not obtained reproducible results.

We hope that in the near future we shall have the necessary facilities for completing these experiments and extending our work to include observations of other biological processes in the same as well as in other systems. Such experiments will undoubtedly lead to a better understanding of how radiations affect biological processes and it is possible that methods may be made available which will permit the measures of biological effects and those of ionization effects to be contrasted.

R. G. Hussey
W. R. Thompson
E. T. Calhoun

Department of Pathology,
Yale University

THE ANTI-STERILITY VITAMIN E AND POULTRY[1]

Herbert M. Evans and George O. Burr,[2] of the University of California, stated in a paper presented at the Washington meeting of the National Academy of Sciences, and reported in Volume LXI, No. 1585, Science, that "sterility is a dietary deficiency disease for it can be cured or prevented by a change in dietary régime, a change involving the addition of certain single natural foods high in a food factor or the addition of very much smaller amounts of extracts of those foods." The work reported was with rats.

In this report they state that Vitamin E is present

[1] Published by approval of the Director of Agricultural Experiment Station as Technical Paper No. 47.

[2] "Anti-Sterility Vit. E," Evans and Burr, Science, 61, 519–520, May 15, 1925.

but extremely low in milk fat and that cod liver oil is notably lacking in Vitamin E and that throughout the life of the animals 9 per cent. by weight of the ration may be constituted of cod liver oil and yet sterility results.

Vitamin E has been found to exist in oats, corn and especially wheat. The wheat germ is said to have an extraordinary richness of E Vitamin. Other feeds reported to contain it are lettuce, dried alfalfa, pea seedlings, rice, yellow corn, rolled oats, velvet bean pod meal, egg yolk and cooked meat.

Katherine Scott Bishop, of the University of California, assisting Herbert M. Evans, and Barnett Sure, of the University of Arkansas, have carried on experiments leading to the same conclusions as those reported in Science on a diet composed of milk casein for protein, cornstarch for carbohydrates, lard for fat and the proper mineral salts, with the addition of a little butter for Vitamin A, yeast for B, orange juice for C and cod liver oil for D. The rats grew normally and thrived but they failed in fertility.[3]

The addition to the dietary of a little lettuce or rice enabled the rats to reproduce. Four successive generations have been raised on such a synthetic diet.

Evans and Bishop have found that the male as well as the female is affected by the lack of this substance and they have been able to extract it from favorable foods by alcohol and ether.

Recent experiments conducted at the University of Idaho on the influence of hatchability of certain feeds of high vitamin content and certain animal protein feeds indicate that nutritional conditions affecting hatchability in chickens apparently differ from those in other animals. In these experiments the hens all received wheat for their scratch feed. During 1923–1924, the basal mash (B) was composed of equal parts of wheat bran, shorts, cornmeal and ground oats, to which was added two pounds of charcoal and four ounces of salt per one hundred pounds. In addition to the mash the birds received grit, oyster shell and water. This ration was lacking in animal protein content. The no-high vitamin feed pen received no feeds in addition to this ration. The dry yeast pen received 2 per cent. dry yeast in the mash and the cod liver pen received 2 per cent. of medicinal cod liver oil in the scratch feed. This oil was mixed into the wheat about every five days.

During 1924–1925, the basal ration was changed. Twenty per cent. peameal was added to the mash and unlimited sour milk was given. No water was available to the hens. This ration (A) contained ample animal protein content for egg production. In 1924–1925 they had the run of pens 8′ x 40′. During 1925–1926 the ration was the same, but the birds were confined the entire year. During 1924–1925 and during 1925–1926, the lawn clippings pen received five pounds of lawn clippings per one hundred birds daily. These lawn clippings contained blue grass and Dutch white clover and had been cured in the sun and then sacked. They were soaked in water before being fed. During 1925–1926, alfalfa leaves and blossoms, prepared in a similar way, were fed in one pen. Both the lawn clippings and alfalfa leaves and blossoms may have some Vitamin D content due to the method used in preparing them.

The following table shows the results of the experiment during the three years, 1923–1926.

TABLE I

Influence of Certain Vitamin Feeds on Hatchability

Feed	Basal Ration B—No Animal Proteins: Year	Basal Ration B—No Animal Proteins: Per cent. hatchability	Basal Ration A—Animal Proteins: Year	Basal Ration A—Animal Proteins: Per cent. hatchability
Cod liver oil			1924–25	61
	1923–24	26	1925–26	57.9
No vitamin feed			1924–25	26
	1923–24	24	1925–26	37.4
Dry yeast			1924–25	38
	1923–24	30		
Lawn clippings			1924–25	54
			1925–26	59.6

Summary of Averages

Feed	Years	Per cent. hatchability
Cod liver oil	1923–26	48.3
No vitamin feeds	1923–26	28.1
Dry yeast	1923–25	34
Lawn clippings	1924–26	56.8

During 1923–24, when the ration was low in animal protein feeds, none of the pens gave good hatchability. The addition of feeds of high vitamin content to this ration was of little value of increasing hatchability. During 1924–1925, the hatchability in the no-high vitamin and dry yeast pens was very poor, while in the cod liver oil and lawn clippings pens it was high. The addition to the ration of animal proteins in the form of sour skim milk was apparently an important factor. During 1925–1926, when the birds were confined during the entire year and the ration again contained sufficient animal proteins the no-high vitamin pen again gave very poor hatchability compared to pens getting cod liver oil, lawn clippings and alfalfa leaves and blossoms.

[3] "Fertility Vitamin," E. E. Slosson, *Sci. Monthly*, 18: 447–8, April, 1924.

Additional experiments involving the influence of different animal protein feeds on hatchability bring out some very interesting and valuable results. Sour skim milk has proved especially valuable. Pens getting sufficient vitamins rarely give poor hatchability when the birds are getting unlimited sour skim milk. It is necessary, of course, that other conditions be right.

The extensive experiments in the feeding of poultry at the University of Idaho Agricultural Experiment Station show conclusviely that reproductive disorders in poultry can not be remedied by simply adding wheat, yellow corn, oats or other feeds which have been found to contain Vitamin E. From the nutritional viewpoint, a combination of factors is necessary for maximum hatching power. In addition to the feeds that the breeding stock are given, there apparently are many other important influences.[4]

RAYMOND T. PARKHURST

IDAHO AGRICULTURAL
EXPERIMENT STATION

THE AMERICAN ASSOCIATION OF MUSEUMS

THE twenty-second annual meeting of the American Association of Museums was held in Washington, D. C., from May 23 to 25. The marked feature of the conference was the extent to which the program was in the hands of members and delegates rather than of scheduled speakers. This circumstance, and the almost complete absence of questions of business, which, during the recent years of association growth have so absorbed attention, produced a meeting of unusual profit.

Coming at the end of the fourth year of the association's work since permanent headquarters were established, the meeting gave opportunity for an appraisal of progress. The reports of officers indicated that the organization has now emerged from the class of experiments and has taken its place squarely in the ranks of established institutions. Its progress has been partly in the nature of financial development, accompanied by increased service, and partly of broadened outlook attendant upon the growth of projects. Among the undertakings completed are the Yosemite Museum—erected by the association and now turned over to the Federal Government; an important traveling exhibit of industrial art objects brought from the recent International Exposition of Decorative and Industrial Arts and circulated to the larger art museums of the country; reports of two surveys of European museums; a field study of small museums in this country, and a report of this work in the form of a "Manual for Small Museums."

The report of the treasurer showed total income for all purposes to be $56,277.41 and total disbursements to be $41,915.98.

Among new projects undertaken during the meeting were an effort in cooperation with the National Education Association to secure the services of a specialist on school museum relations, and establishment of a demonstration small museum. A course of training for museum work, which has been under contemplation for some time, was announced for next fall, and progress was reported in the development of a clearing-house service for exchange and redistribution of museum collections.

The general sessions of the conference were held on three successive mornings—at the Smithsonian Institution, the American Red Cross National Headquarters—where the Red Cross Museum is located—and the Corcoran Gallery of Art, respectively. One principal paper on each morning was followed by a full discussion and a series of committee reports. There was an outdoor afternoon session following luncheon at the Great Falls of the Potomac; an evening devoted to simultaneous sessions on art, science and history problems, and a final banquet at which the speakers were: Dr. E. E. Lowe, of Leicester, England, representative of The Museums Association of Great Britain; Lorado Taft, of Chicago, and Dr. L. O. Howard, of Washington, D. C. The presidential address was delivered by Chauncey J. Hamlin, president of the Buffalo Museum of Science.

The free discussion, which figured so prominently in the meeting, was responsible for two impromptu sessions devoted to educational work—a subject of outstanding importance to museum workers at the present stage in the development of their technique. The ranks of museum educational workers were supported by a number of school representatives, whose presence indicated a new tendency on the part of school boards to inquire actively into museum cooperation.

Officers were elected for the coming year as follows:

President, Chauncey J. Hamlin, Buffalo.

Vice-presidents, Fiske Kimball, Philadelphia; Arthur C. Parker, Rochester; Charles R. Richards, New York, and George H. Sherwood, New York.

Secretary, William deC. Ravenel, Washington.

Treasurer, George D. Pratt, New York.

LAURENCE VAIL COLEMAN,
Director

[4] "The Feeding and Management of Breeders," R. T. Parkhurst, Agricultural Experiment Station Circular No. 44, April, 1927.